Introduction

The Energy Star® Upgrade Manual for Buildings is a guide for planning and implementing profitable upgrades that will improve the energy performance of your facilities. The Manual is a guide for developing a comprehensive energy management strategy and an integrated approach to upgrading existing buildings. It also provides information on proven energy-efficient technologies that can produce energy savings of 35% or greater by following the staged process outlined in the manual.

Energy Star Overview

Energy Star is a dynamic voluntary government and industry partnership that makes it easy for businesses and consumers to save money and protect the environment. In 1991, the US Environmental Protection Agency introduced the Green Lights program, a voluntary program that encouraged organizations to upgrade their lighting to energy efficiency lighting systems and controls. The labeling program was launched the following year and the Energy Star brand was introduced. The Energy Star brand identifies energy-efficient products and promotes energy performance that saves energy and protects the environment. In 1996, EPA partnered with Department of Energy to increase the product offerings of the Energy Star label. The label was expanded to include new homes, commercial and institutional buildings, residential heating and cooling equipment, major appliances, office equipment, lighting, and consumer electronics. Green Lights, ClimateWise, and all labeled products have been consolidated under one umbrella; Energy Star. Now, the suite of products and offerings all bear the Energy Star logo. From labeled buildings and homes to labeled products, the Energy Star logo makes it easier for businesses and consumers to recognize the symbol for exemplary energy performance, saving money and pollution prevention.

You Can Make A Difference

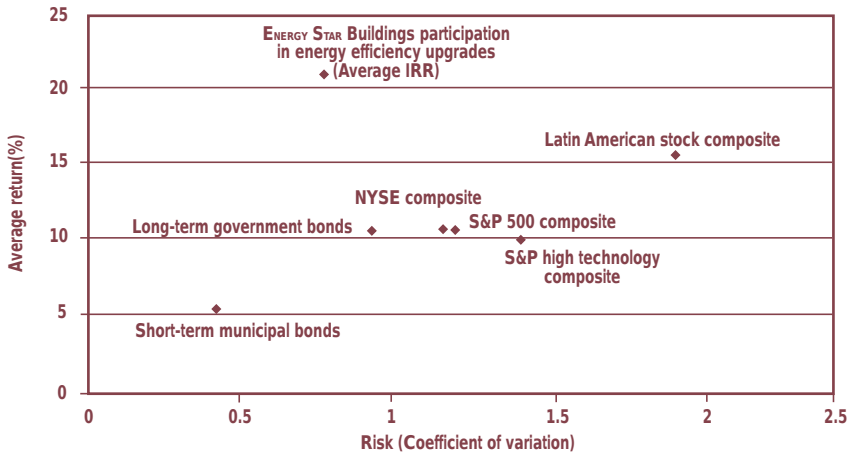
With Energy Star, money isn't all you'll save! Whether your business is education, retail, manufacturing, or healthcare, you can profit from a new source of value by adopting energy management best practices that promotes exemplary energy performance in your buildings. If all US consumers and businesses were to choose Energy Star products and building upgrade strategies over the next decade, the national annual energy bill would be reduced by about $200 billion. Consumers and businesses would not only save money but would also make a huge reduction in air pollution and contribute to protecting the earth's atmosphere for future generations. Energy Star has contributed to 6.4 million metric tons of carbon reductions and 31.6 billion kWh savings since the inception of its flagship program.

Upgrading Your Buildings

Energy efficiency prevents pollution and is good for your bottom line as well as the environment. Your organization will save the money that was previously spent on energy-wasting equipment and technologies. Reductions in energy consumption also enable you to deliver products and services at a lower cost and increase profits, which means being more competitive. The potential savings from an integrated approach to energy-efficient upgrades can be 35% or greater. For example, energy bills for existing US commercial space (approximately 78 billion square feet) total $110 billion annually. EPA estimates that increasing the energy efficiency of this space could save more than $25 billion. In addition to dollar savings, there are several other benefits for incorporating energy efficiency into your business strategy:

- ENERGY STAR upgrades offer superior returns at a lower risk than many other investments (see Figure 1).
- Improvements in energy performance and employee comfort can increase productivity in your upgraded buildings; in fact, revenue generated from increased productivity can be 10 times as high as the energy cost savings received from performing upgrades.
- Every dollar invested in an energy-efficient upgrade can produce between $2 and $3 in increased asset value, which can make commercial properties more attractive to buyers and lenders.

Figure 1: Risk vs. Return



Improving energy performance offers long-term, low-risk returns, reductions in energy consumption and costs, increases in worker productivity, and improved asset value, few other investments can do all that. And each day that you delay your decision to upgrade, you lose those potential savings forever.

An Integrated Upgrade Approach

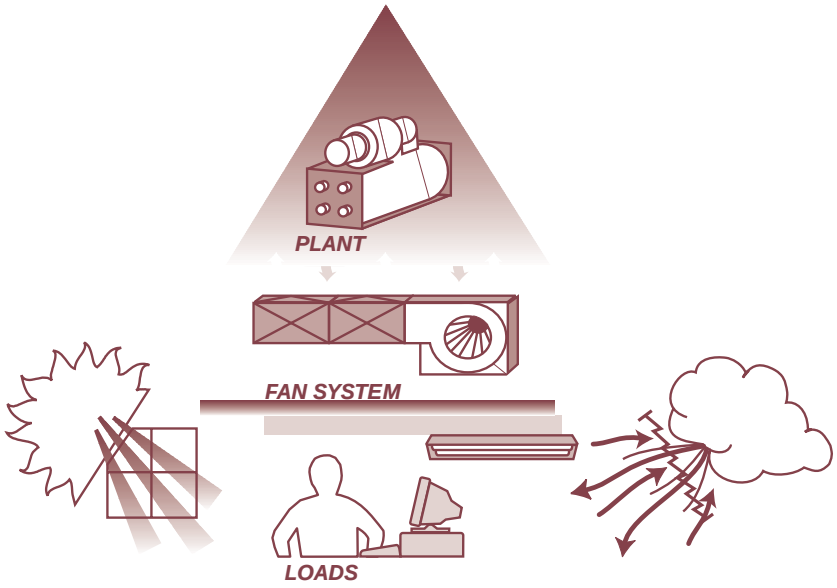
An integrated upgrade approach is a formula for success that includes the following factors:

- Involving the right people in your organization — EPA encourages top management commitment and targets top level executives in promoting energy performance and pollution prevention.
- Benchmarking energy performance — EPA advocates benchmarking energy performance (EPA's portfolio manger) to optimize energy use and achieve maximum energy and cost savings, and using proven energy-efficient technologies and an integrated approach for building upgrades.
- Communicating results —EPA recognizes participants' successes to increase public awareness on the benefits of energy performance. Nothing is more convincing than success!

The rationale and approach to energy efficiency upgrades introduced below are designed to maximize your rate of return for energy-efficient investments.

Underlying the integrated approach for building upgrades is a basic understanding of how to improve energy performance. Figure 2 illustrates how heat and energy flow in a building. Heat is given off by lights, people, and other supplemental loads; such as office equipment requires space cooling. Solar radiation and hot outside air temperatures can also impact space cooling needs. Conversely, cold outside air temperatures create the need for heating. Even when it is cold outside, your building may still require some cooling to remove excess heat given off by lights, people and equipment.

Figure 2: Heat Flow In Buildings



Heat Flow In Buildings: Building Systems Interactions

Figure 2 shows the interaction of heating, cooling, and electrical loads with the HVAC equipment. Arrows indicate heat flow pathways. Reducing heating, cooling, and electrical loads reduces the demand on HVAC equipment, thus saving energy.

The staged approach synthesizes these interactions into a systematic method for planning upgrades that enables you to maximize energy savings. The stages are:

- **Recommissioning:** Periodically examine building equipment, systems, and maintenance procedures as compared to design intent and current operational needs.
- **Lighting:** Install energy-efficient lighting systems and controls that improve light quality and reduce heat gain.
- **Supplemental Load Reductions:** Purchase ENERGY STAR labeled office equipment, install window films and add insulation or reflective roof coating to reduce energy consumption of supplemental load sources.
- **Fan Systems Upgrades:** Properly size fan systems, adding variable speed drives, and converting to a variable-air-volume system.
- **Heating And Cooling System Upgrades:** Replace chlorofluorocarbon chillers, retrofit or install energy-efficient models to meet the building's reduced cooling loads, upgrade boilers and other central plant systems to energy-efficient standards.

When the staged approach is performed sequentially, each stage includes changes that will affect the upgrades performed in subsequent stages, thus maximizing energy and cost savings. The first three stages, Recommissioning, Lighting, and Supplemental Load Reductions, address reducing heating, cooling, and electrical loads. Once these loads are reduced, you can upgrade HVAC equipment to meet the current loads and optimize its performance. By implementing the load reduction strategies first, the savings from fans and HVAC systems will be greater because these systems can be properly sized to handle the reduced loads.

Build Your Building Right

After many requests from our participants to help them achieve ENERGY STAR for new building projects, EPA has expanded its experience in energy performance for existing buildings to the new buildings arena. It has been documented that when high performance buildings are designed from the start, they are generally more efficient and cost less than upgrading after the fact. Buildings systems and materials can be designed as integral network that will improve energy performance.

ENERGY STAR provides guidance for design teams and building owners on new building design strategies to enhance energy performance. The New Building Design initiative is web based and will walk you through the design process and provide tools to help you make informed decisions about energy performance on new design projects. It starts with setting goals and ends with achieving the ENERGY STAR label for your building. It also address all other design phases from pre-design to construction and bid documents. Energy performance is the driving element in the discussion at each phase. It will help you identify or ask the question, "How will this design decision effect the energy performance of the building?"

Target Finder, a web based energy performance calculator, will help you set a target early in the process. You can also measure your progress along the way by comparing your simulated energy consumption to your target. The difference between the simulated and target can assist in determining relative efficiency, identifying gaps and making improvements to energy performance strategies. The benefit is that energy strategies are incorporated as an integral part of the design and can be compared to industry benchmarks to monitor progress toward reaching your energy performance goals.

Get Started Now

You can become an ENERGY STAR partner and receive the benefits of membership! Your organization signs a Partnership Agreement stating that they are committed to improving energy performance by:

1. Measuring, tracking, and benchmarking energy performance using tools such as those offered by ENERGY STAR,
2. Developing and implementing a plan to improve energy performance in your facilities and operations by adopting the strategy provided by ENERGY STAR,
3. Educating your company and community about your achievements and partnership with ENERGY STAR.

EPA will provide you with resources and assistance; such as analytical software tools, publications, and technical guidance to assist you with achieving exemplary energy performance goals. You can learn more about the obtaining the suite of offerings from:

ENERGY STAR on the Web	www.energystar.gov
ENERGY STAR Hotline	1-888-STAR YES (1-888-782-7937)